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AUTHOR Kintgen-Andrews, Jean
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ABSTRACT

A study compared career ladder practical nursing (PN) and associate degree (AD) nursing students with their university counterparts with regard to the development of critical thinking over an academic year. The sample included 55 PN students, 55 AD students, 38 pre-health science freshmen, and 29 generic baccalaureate sophomore nursing students. The PN students were in the first year of a career ladder program and the AD students the second year. There was no significant difference between the Watson-Glaser Critical Thinking Appraisal scores of the PN students and the pre-health science freshmen at either the fall or spring testing. The sophomore students scored significantly higher than the AD students at both the fall and spring testings; however, questions were raised about the samples compared. None of the four groups made significant gains in critical thinking over the academic year. (Author/KC)

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Development of Critical Thinking: Career Ladder P.N. and A.D. Nursing Students, Pre-Health Science Freshmen, Generic Baccalaureate Sophomore Nursing Students

Jean Kintgen-Andrews, PhD, RN
Associate Professor
University of Minnesota
School of Nursing

Running Head: Development of Critical Thinking

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Abstract

The purpose of this study was to compare career ladder practical nursing (P.N.) and associate degree (A.D.) nursing students with university counterparts with regard to the development of critical thinking over an academic year. The sample included 55 PN students, 55 AD students, 38 pre-health science freshmen, and 29 generic baccalaureate sophomore nursing students. The PN students represent the first year of a career ladder program and the AD students the second year. There was no significant difference between the Watson Glaser Critical Thinking Appraisal scores of the PN students and the pre-health science freshmen at either the Fall or Spring testing. The sophomore students scored significantly higher than the AD students at both the Fall and Spring testings; however, questions are raised about the samples compared. None of the four groups made significant gains in critical thinking over the academic year. The results of previous studies are integrated into the discussion of the results of the present study.

Introduction

This study focuses upon the development of critical thinking in practical nursing and associate degree nursing students in a regional consortium career ladder program. Comparisons are made between practical nursing students and pre-health science freshmen and between associate degree nursing students and sophomores in a generic baccalaureate program. Nurse researchers have demonstrated a high level of interest in critical thinking and clinical judgment/problem solving. A review of the literature in this field provides a back-drop for the present study.

Previously Reported Studies

The studies identified may be classified under the following headings: prediction of success in nursing education, impact of nursing education, and relationship between critical thinking and clinical judgment/problem solving.

Prediction of Success in Nursing Education

Tiessen (1986) studied a sample of 150 baccalaureate students. Using multiple regression analysis, she examined intercorrelations between the score on the Watson-Glaser Critical Thinking Appraisal (WGCTA) and eight other variables. Scholastic Aptitude Test (SAT) quantitative score, total number of credits in the arts and humanities, and entering grade point average (GPA) were most highly correlated.

Bauwens and Gerhard (1987) studied a sample of baccalaureate students. Students who took the WGCTA in their first term as upper-

division nursing students totaled 145. Of these, 53 repeated the WGCTA in the final month prior to graduation. Pearson correlation and multiple regression analysis were used to examine relationships with other variables. No significant difference was found between the entry and exit test. The correlation between the WGCTA entry score and the National Council Licensing Examination (NCLEX) was .31 (p = .002). The entry WGCTA score and the entry grade point average together accounted for 15% of the variance in NCLEX scores (p = .001). Because there was no significant change in the WGCTA score at the end of the educational program, the investigators concluded that specific nursing educational experiences (such as exposure to scientific method or nursing process) do not produce gains in critical thinking ability and that the WGCTA is not a valid measure of specific cognitive processes underlying nursing process. They concluded, however, that the findings do support the usefulness of the WGCTA as a pre-admission predictor of nursing success.

Impact of Nursing Education

The Bauwens and Gerhard study cited above deals with the impact of nursing education as well as prediction of success, i.e., the conclusion that specific nursing education experiences do not produce gains in critical thinking as measured by the WGCTA.

Gross, Takazawa, and Rose (1987) studied the impact of nursing education on students' critical thinking abilities and also evaluated the WGCTA as a predictor of success in nursing education. Of a sample of 60 associate degree and 60 baccalaureate students, 37 associate degree and 34 baccalaureate students completed the program and took the

WGCTA on entry and exit. This study is the only one identified in the present review which showed significant gains in WGCTA over the course of an educational program. Both associate degree and baccalaureate students made significant gains. Using multiple regression analysis,the investigators also concluded that success on the NCLEX is best predicted by the cumulative program GPA which summed up effects of the WGCTA and National League for Nursing (NLN) Pre-Admission test scores. The entry WGCTA as an early predictor, however, has a .38 ($p < .05$) correlation with cumulative program GPA.

Verhonick, Nichols, Glor, and McCarthy (1968), using a sample of 1,576 registered nurses, studied the abilities of these nurses, on watching five filmed clinical situations developed by the investigators, to make relevant observations, describe the actions they would take, and explain the rationale. Descriptive analyses indicated that relevant observations and the ability to relate actions to these observations were positively related to the academic degree held. A decline in the number of relevant observations made was associated with greater than six years of nursing experience.

Davis (1972), using the instrument developed by Verhonick, studied 20 clinical nurse specialists and 20 baccalaureate graduates. Later, she studied 40 clinical nurse specialists, 20 baccalaureate graduates, and 27 diploma nurses (Davis, 1974). Results of the two studies were similar. The investigator reported that significant differences in responses indicated that the quantity and quality of patient care provided by the clinical nurse specialist was superior to that provided by baccalaureate nurses and the care provided by baccalaureate nurses

was superior to that provided by the diploma nurses. The findings indicated, however, that with increasing nursing experience unaccompanied by educational refresher courses, the quality and quantity of nursing care by all practitioners declined.

Frederickson and Mayer (1977), using patient situations from the Verhonick series, studied 28 baccalaureate students and 27 associate degree students in the last semester before graduation. All the students also took a standardized general problem solving test. There was no significant difference between the two groups in the process of problem solving relevant to the Verhonick situations. The baccalaureate degree students, however, did score significantly higher on the general problem solving test.

Aspinall (1976), using a single written case study to evaluate clinical judgment, asked 187 nurses to identify possible causes for the patient's condition. Nurses with baccalaureate degrees scored higher than associate degree and diploma graduates. Performance was lower for nurses with ten or more years of experience.

Polifroni (1981) studied 90 generic baccalaureate "preservice" senior students, 85 generic baccalaureate "inservice" senior students, and 83 upper division program "inservice" senior students. She used an instrument called the Revised Nursing Process Utilization Inventory (RNPUI) as a measure of nursing problem solving ability and the WGCTA as a measure of general reasoning ability. Generic baccalaureate preservice and inservice students scored significantly higher on both instruments than did the upper division program seniors. Covariates found to have significance for performance on the RNPUI for upper

division and generic inservice seniors were age, rank in high school class, and years of postsecondary experience. Work experience had significance for one measure on the RNPUI for upper division seniors only.

Scoloveno (1981) in a study similar to Polifroni's used the same instruments. Scoloveno, however, compared 90 senior baccalaureate students, 93 "senior" associate degree students, and 97 "senior" students in hospital based programs. The baccalaureate seniors scored significantly higher (beyond .01 level) than associate degree and hospital-based students on both simulated nursing situation tests (primary care, acute and chronic care) comprising the RNPUI. Baccalaureate students scored significantly higher than associate degree or hospital based students on the WGCTA. Associate degree students scored significantly higher (beyond .01 level) than the hospital-based students on the acute and chronic care test. There was no significant difference between the associate degree and hospital-based students on the primary care test.

Del Bueno (1983) studied 85 nurses with associate degree, diploma, and baccalaureate preparation. Using a newly developed series of 12 patient situations, she asked for the three responses requested in the Verhonick instrument (identify clinical problems, describe what the nurse would do, provide rationale for actions). Academic preparation and experience were related to clinical judgment ability. Experienced baccalaureate graduates performed best.

Pardue (1987) investigated the differences in critical thinking ability and decision making skills among 121 associate degree, diploma,

baccalaureate, and master's prepared nurses. Nurses with master's and baccalaureate degrees had the highest scores on the WGCTA. No significant differences were found among the four groups on any of the following measures of decision-making: self-reported frequence of decisions made, self-reported perceived difficulty in making decisions, and self-reported factors which influence decision making. Each of the four groups ranked factors influencing decisions in the same order: experience, knowledge, values, role model, stress.

Sullivan (1987) studied critical thinking and clinical performance (as well as creativity). Forty-six registered nurses who entered and completed a baccalaureate program participated. The WGCTA and the Steward Evaluation of Nursing Scale developed at Wayne State University were utilized. Critical thinking scores showed no difference at entry and exit. Clinical performance scores were significantly higher at graduation.

Relationship Between Critical Thinking and Clinical Judgment/Problem Solving

Tanner (1987) cites four studies on the relationship between different measures of clinical judgment and general problem solving ability. These studies are discussed below.

Tanner (1977), in her study of 54 senior baccalaureate nursing students, found no relationship between WGCTA scores and any of the seven dependent measures related to clinical judgment.

Matthews and Gaul (1979), studying 22 undergraduate and 26 graduate students, examined the relationship between critical thinking ability as

measured by the WGCTA and ability to derive a nursing diagnosis. There was no significant difference between the two groups' scores on the WGCTA. The graduate subjects, however, demonstrated significantly greater ability to derive nursing diagnoses from the case study presented. The correlation between the WGCTA scores and ability to derive nursing diagnoses was not significant.

Holzemer and McLaughlin (1988), carried out a study of the validity of two types of clinical simulation tests utilizing 34 nurse practitioners with either associate or baccalaureate degrees. All participants took the WGCTA. There were no significant correlations ($p > .10$) between the simulation scores and the WGCTA scores. The investigators concluded that the simulation and WGCTA instruments measure different dimensions of decision making.

Gordon (1980) used a concept attainment model to study the influence of inferential ability as measured by the Miller Analogy Test or the Verbal Aptitude Subtest of the Graduate Record Examination on hypothesis-scanning strategy, diagnostic accuracy, and confidence in the diagnosis. Level of inferential ability did not significantly influence predictive hypothesis testing. Neither were accuracy or confidence in diagnosis influenced by level of inferential ability.

Another study that relates to the relationship between critical thinking and clinical judgment/problem solving was done by Dungan (1986). She compared the Cornell Critical Thinking Test (CCTT) scores with scores on the Nursing Process Utilization Inventory (NPUI) which tests students' ability to generate nursing problems and appropriate interventions for a clinical simulation. The sample consisted of 23

entry freshmen, 31 associate degree students within one month of program completion, and 43 baccalaureate students within a month of program completion. No significant differences were found between the groups on the CCTT. There was a significant difference, however, in the way the groups performed on the NPUI. The investigator attributed the difference to the level of nursing knowledge acquired. CCTT scores accounted for less than 1% of the variance in NPUI scores whereas the accumulation of nursing credits accounted for 56%. The investigator refers to the CCTT scores as the logical dimension of critical thinking and to specific nursing knowledge as the pragmatic dimension of critical thinking.

Katefian (1981) conducted a study considerably different from those discussed above. The focus of this study was the relationship between critical thinking, educational preparation, and the level of moral judgment. Seventy-nine practicing nurses participated. There was a correlation of .5326 ($p = <.001$) between critical thinking as measured by the WGCTA and moral judgment as measured by Rest's Defining Issues Test. The moral judgment scores of professional nurses were also significantly higher than those of technical nurses. Critical thinking and education together accounted for 32.9% of the variance in moral judgment.

Present Study: Focus on Career Ladder Program

As stated earlier, the investigator was particularly interested in the development of critical thinking in students in a consortium career

ladder program. In this consortium, a non-traditional practical nurse curriculum prepares students for practice at the practical nurse level and also serves as the base for a non-traditional one year associate degree curriculum. Associate degree graduates, usually after some practice at that level, may enter one of two generic baccalaureate programs on the basis of articulation plans with those programs. (As of this time, these graduates also have other options for baccalaureate education.) Because the career ladder route of the one year practical nursing curriculum followed by the one year associate degree curriculum and the generic baccalaureate program route of the freshman and sophomores years are parallel approaches to the final two years of professional education leading to the baccalaureate degree, it seemed reasonable to compare the development of critical thinking in career ladder and generic students during each of the first two years of their respective courses of study. In other words, the investigator was interested in comparing (a) practical nursing students with freshmen preparing to enter a health science program and (b) associate degree nursing students with sophomore generic nursing students. Some studies have compared second year associate degree students with seniors in generic baccalaureate programs but the philosophy of the consortium program under study is that there is a distinct difference between associate degree "seniors" and baccalaureate seniors; the associate degree graduate, like the entering junior has two additional years for professional development.

The present study, therefore, asked the following questions: (a) At the beginning of the academic year, how do critical thinking scores

of the practical nursing students compare with those of freshmen who planned to enter a health science program? (b) At the end of the academic year, how do critical thinking scores of the practical nursing students compare with those of freshmen who had planned to enter a health science program? (c) At the beginning of the academic year, how do critical thinking scores of the associate degree nursing students compare with those of sophomore generic baccalaureate nursing students? (d) At the end of the academic year, how do critical thinking scores of the associate degree students compare with those of the sophomore generic baccalaureate nursing students? (e) To what extent is critical thinking developed over the academic year in each of the four groups?

The study also examined relationships between critical thinking scores, age, total amount of employment experience, amount of employment experience in nursing, educational goal, number of previous college credits, nursing grade point average, final nursing course grade, and state board examination score as these data score available for each of the four groups of students.

Method

The Sample

The sample included volunteers from two levels of a career ladder nursing program, 55 practical nursing students and 55 associate degree nursing students; 38 pre-health science freshman university students; and 29 sophomore students in generic baccalaureate nursing programs. The practical nursing students represented three schools belonging to

the same consortium and using a common curriculum. The associate degree students also represented a consortium school utilizing a one year curriculum built upon the base of the consortium practical nursing curriculum. The freshman students representing two universities planned to enter either a baccalaureate nursing program or another health science program. The sophomore students were enrolled in generic baccalaureate nursing programs in two universities. (The two university schools of nursing are members of the same educational consortium and have agreed to articulation plans for the completion of the baccalaureate degree.) While the practical nursing and associate degree students represented all the students in the respective programs who were present to complete the tests at the beginning and end of the year, the freshmen and sophomores were volunteers from larger groups who responded to an invitation to participate.

Table 2 provides information about age, total employment experience in years (Tex), nursing employment experience in years (Nex), college credits attained in terms of quarter hours (Ccr), and educational goal designated as practical nurse, associate degree, baccalaureate, master's, doctorate (Ego). All data represent responses at the beginning of the academic year of the study. Information about college credits attained by associate degree students is omitted because responses were not always clear. Available data, however, indicates a range of approximately 38 to 251 quarter credits. The career ladder students (practical nursing and associate degree) were older and had had more employment experience than the freshmen and sophomores. The practical nursing students had acquired more college credits prior to

entrance than the particular group of pre-health sciences freshman who participated. While the majority of practical nursing and associate degree students desire to advance beyond their present level, the sophomore group includes the highest percentage aspiring to graduate education.

Insert Table 2 about here

The Process and the Instrument

At the beginning of the 1985-86 academic year, demographic data were collected and the Watson-Glaser Critical Thinking Appraisal (CTA) was administered. The CTA was administered again at the end of the academic year. No time limit for the completion of the test was imposed but most examinees finished within forty minutes. The CTA is available in two equivalent forms (Form A and Form B). In each group at the beginning of the year, Form A was administered to half of the students and Form B to the other half. At the end of the year, students who received Form A received Form B and vice versa. (A limitation in the use of the two alternative forms concurrently is that not all students who took the test in the Fall continued to participate in the study in the Spring. Therefore, the number in each group who took Form A followed by Form B was not equal to the number who took Form B followed by Form A. This, of course, does not constitute a problem if Form A and Form B are clearly equivalent as the authors claim they are.)

The authors of the CTA viewed critical thinking as a composite of attitudes, knowledge, and skills. They state:

> This composite includes: (1) attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; (2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined; and (3) skills in employing and applying the above attitudes and knowledge. The Critical Thinking Appraisal seeks to provide an estimate of an individual's standing in this composite of abilities by means of five subtests, each designed to tap a somewhat different aspect of the composite. A high level of competency in critical thinking, as measured by the CTA, may be operationally defined as the ability to perform correctly the universe of tasks represented by the five subtests (Watson & Glaser, 1980, p. 1).

The five subtests referred to above are: Inference, Recognition of Assumptions; Deduction; Interpretation, and Evaluation of Arguments. The CTA exercises include problems, statements, arguments, and interpretations of data similar to those that are encountered on a daily basis at work, in the classroom, and in newspaper and magazine articles. The test calls for responses to items having "neutral" content and items with "controversial" content (Watson & Glaser, 1980).

Content and construct validity of the CTA has been assessed through its use in instructional programs aimed at developing critical thinking

ability. The CTA has been shown to relate to various measures of academic achievement. While it has also been shown to relate to measures of general intelligence, factor analysis of the subtests with other measures of intelligence show that the CTA is measuring a dimension of ability that can be seen as distinct from overall intellectual ability (Watson & Glaser, 1980).

The reliability of the CTA has been assessed in several ways. The test manual for the CTA presents a test-retest correlation of .73, an alternate forms (Form A versus Form B) correlation of .75, and split-half reliability coefficients ranging from .69 to .85 for Form A and from .70 to .82 for Form B. (Watson and Glaser, 1980) The investigator, utilizing the responses of a group of 25 practical nursing students, arrived at a split-half reliability coefficient of .75 for Form A and .75 for Form B.

Results

A comparison of Fall CTA scores for practical nursing students and pre-health science freshmen is presented in Table 3. Although the freshman composite score is higher, there is no significant difference. Among the subscales, the only significant difference is in the Evaluation of Arguments test score where the freshman score is higher.

Insert Table 3 about here

A comparison of Spring CTA scores for practical nursing students and pre-health science freshmen is presented in Table 4. The freshman

composite score is higher but there is no significant difference nor are there any significant differences in the subscores.

Insert Table 4 about here

Table 5 presents a comparison of Fall CTA scores for associate degree students and sophomore generic baccalaureate students. Significant differences are present between the two groups in the composite scores and all of the subscale scores.

Insert Table 5 about here

Table 6 presents a comparison of Spring CTA scores for associate degree students and sophomore generic baccalaureate students. Significant differences are present between the two groups in the composite scores and all subscale scores except the Recognition of Assumptions.

Insert Table 6 about here

Tables 7, 8, 9, and 10 address the question of the level of critical thinking development that occurred over the academic year for each of the four groups of students.

Mean composite scores at the end of the academic year are higher than those at the beginning of the year for all groups except the

sophomores but none of these gains are significant at the .05 level. The sophomores who achieved higher scores than any of the other groups in both Fall and Spring, nevertheless, had a mean composite scores at the end of the year which was actually lower than the mean composite score at the beginning of the year. The loss,however, was not significant at the .05 level.

The only significant subscore gains were on the Inference subtest. Both freshmen and sophomores made significant gains on this subscale and the positive sophomore "difference score," 1.0345, is significantly higher than the negative associate degree score, -.1455 (p = .032). Practical nursing students made their greatest gain on this subscale although the gain was not significant. The associate degree students did not make significant gain on any of the subscales but made their highest gain on the Evaluation of Arguments subtest. For the other three groups, the Evaluation of Arguments subscale either represents the highest loss or is among the subscales representing the highest loss. None of these losses are significant at the .05 level; however, the positive associate degree "difference score" for Evaluation of Arguments, +.5273, is significantly higher than the negative sophomore score, .-7241 (p = .035).

Insert Tables 7, 8, 9, 10 about here

Tables 11, 12, 13, and 14 present Pearson correlation coefficient matrixes for each of the four study groups showing the relationships between critical thinking scores and the following relevant variables:

age at the beginning of the academic year, amount of nursing employment experience prior to the beginning of the academic year (Nex), amount of total employment experience prior to the beginning of the academic year (Tex), level of educational goal beyond the present program (Ego), college credits attained prior to the beginning of the academic year (Ccr), nursing grade point average for the academic year (Ngpa), final nursing course grade (Synth), and National Council licensing examination grade (NCLEX). The final nursing course of the academic year for each of the groups is a clinical synthesis course in which the student is expected to integrate learning from previous nursing courses during the academic year. As indicated above, previous college credits are not available for associate degree students. Since thirty-three of the thirty-eight freshmen had earned no previous college credit, college credits were not included in the correlations for freshmen students. Because the freshmen were pre-health science students interested in entering a variety of programs, neither nursing grades nor NCLEX scores are not included for them. Finally, because the sophomore baccalaureate students did not take the licensing examination until the end of their senior year, there are no data on the NCLEX for them. In connection with the NCLEX, it should be noted that practical nursing graduates take the NCLEX-PN and associate degree graduates take the NCLEX-RN, two very different tests.

CTA Scores and Achievement Measures

Interest in critical thinking among nurse educators is based to a great extent upon the perception of nursing as largely a problem

solving process. From this standpoint, consideration is given to the use of measures of critical thinking as predictors of success in a nursing curriculum and the development of critical thinking within the nursing curriculum as an issue. Tables 11, 13, and 14 identify significant positive correlations between CTA scores and measures of achievement in nursing as follows:

(a) between CTA Fall and/or Spring scores and nursing grade point average for all three groups of nursing students;

(b) between CTA "difference scores" and nursing course grade for practical nursing students;

(c) between both CTA Fall and Spring scores and final nursing course grades for practical nursing students;

(d) between both CTA Fall and Spring scores and NCLEX scores for both practical nursing and associate degree nursing students. (No NCLEX scores available for sophomores.)

CTA Scores and Other Variables

Several significant correlations between CTA scores and other variables identified in Tables 11 through 14 are of particular interest:

(a) Age has a positive correlation with both the CTA Fall and the CTA Spring scores for sophomores, with the CTA Spring scores for practical nursing students, and with the CTA Fall scores for freshman students.

(b) Educational goal has a positive correlation with both the CTA Fall and CTA Spring scores for practical nursing students.

(c) Number of college credits has a positive correlation with CTA Fall scores for practical nursing students and sophomores. (College credits are not available for associate degree students and were not correlated for freshmen.)

(d) Amount of previous nursing employment experience has a negative correlation with Fall CTA scores for associate degree students and CTA "difference scores" for sophomores. (Amount of previous nursing experience has negative but not significant correlations with other CTA scores and has negative correlations, some of which are significant, with measures of achievement.)

Insert Tables 11, 12, 13, & 14 about here

Discussion

Several considerations are basic to comparisons between the beginning practical nursing students and the beginning university freshmen preparing to enter a health science program. While the practical nurse students in the career ladder program will "spin off" at different levels, those mobilists who will proceed to the baccalaureate degree are in effect beginning a program of approximately four years of full time study or the equivalent in part-time study. Likewise, the freshmen are beginning a professional program of at least four years of full time study or the equivalent in part-time study. On the other hand, Table 2 points to differences between the groups. The practical nursing students are older and have had more employment experience. The

practical nursing students have also acquired more college credits than the freshmen in the particular group that volunteered to participation in the study. On the other side of the coin, 77.3% of the freshmen intend to attain baccalaureate degrees and 22.7% graduate degrees while only 29.1% of the practical nursing students intend to attain baccalaureate degrees and 9.1% graduate degrees. If the goals expressed are generally predictive of the educational levels achieved by the two groups, one would conclude that there will be a considerably lower percentage of practical nursing students presenting themselves for baccalaureate education than freshmen actually moving into the upper division of baccalaureate study.

Tables 3 and 4 show that the freshman composite scores were higher in both the Fall and the Spring than the practical nursing students' scores; however, the differences between the two groups were not significant. One might, therefore, conclude that the two groups entered the first year of their respective educational endeavors with similar levels of competence in critical thinking and completed their first year with similar levels of competence. One might conjecture that the slightly higher scores of the freshmen would be offset by elimination of the scores of practical nursing students who will not proceed to baccalaureate education.

As in the case of the groups discussed above, several factors are to be considered in making comparisons between the associate degree students and the sophomore generic baccalaureate nursing students. While many of the associate degree students (who began their nursing education in a practical nursing program) will "spin off" at the

completion of the associate degree year, those mobilists who will proceed to the baccalaureate degree are in effect in their second year of four years of full time study or the equivalent in part time study. Likewise, the sophomores are in the second year of a four year professional program. Table 2, however, points to some differences between the groups. Again, the career ladder students (associate degree) are the group who are older and have had more employment experience. Again, the university students have higher educational goals: 41.4% intend to earn baccalaureate degrees and 58.6% intend to earn graduate degrees as compared with 53.9% of the associate degree students who plan to earn baccalaureate degree and 7.7% who plan to earn master's degrees.

Tables 5 and 6 show that sophomore CTA composite scores are significantly higher than associate degree scores at both the Fall and Spring testings. These data indicate that the sophomores began their second year with significantly greater competence in critical thinking than did their associate degree counterparts.

One needs, however, to look more closely at the two groups involved. The sophomore group is composed of individuals who have been screened and accepted into baccalaureate nursing programs. Furthermore, while all the AD students in the particular class volunteered to participate in the study, only a part of the total sophomore group volunteered. Since most of these sophomores have now completed the baccalaureate program additional data concerning them are available. It is interesting to note that data from one of the baccalaureate programs indicate that the 22 participants in the study had a mean "unit" grade

point average (GPA after acceptance into the nursing major) of 3.41 based upon data available after the Spring quarter 1988 while the 24 nonparticipants in that program had a mean GPA of 3.12. 54% of the participants achieved above the class mean while only 42% of the nonparticipants achieved above the mean.

While the sophomores who participated in the study may be a somewhat select subgroup of an overall group who have been screened and actually accepted into baccalaureate nursing programs, the associate degree students are all members of an entire class who were present for the Fall and Spring testings. It is difficult to project how many of these persons will even present themselves for baccalaureate education. However, if one were to eliminate persons who achieved relatively low National Council Licensing Examination (NCLEX) scores on the assumption that they will probably not present themselves for baccalaureate education, the CTA mean score rises considerably. For example, even eliminating the lower 40% of the 47 associate degree students for whom NCLEX scores are now available raises the mean CTA score for Fall to 58.54.

In summary, comparison of the means reported in Tables 5 and 6 must be interpreted in terms of the composition of the two groups. Members of the associate degree group who are destined to enter baccalaureate education would probably have achieved considerably higher CTA scores than those achieved by the entire associate degree group. If, as seems to be the case, the sophomores represented in the study were a somewhat select subgroup, the entire classes of sophomores would probably have achieved lower CTA scores than the volunteer subgroups.

Critical Thinking Development

The investigator's greatest interest at the outset of this study was to compare the development over the academic year of critical thinking of practical nursing and associate degree students in a career ladder program with their counterparts in university situations. There were no significant differences between the groups in the changes in critical thinking ability. What was extremely disappointing, however, was that none of the groups made significant gains and, indeed, the sophomores' Spring CTA mean composite score was lower than their Fall score (See Tables 7, 8, 9, and 10). Since the importance of making inferences has been stressed in connection with the practice of nursing, it is interesting to note that the sophomores did make a significant gain on the Inference subscale and the practical nursing students made their largest gain on this subscale. Two studies which were reported while the present study was in process also indicate no significant differences in composite scores. Bauwens and Gerhard (1987)tested baccalaureate students at entry to the upper division and just prior to graduation. Sullivan (1987) tested registered nurse students on entry to and exit from a baccalaureate program. Gross et al. (1987), on the other hand, report significant gains between entry and exit into nursing programs for both baccalaureate and associate degree students and find a .38 correlation between the exiting WGCTA scores and NCLEX scores ($p < .05$).

The findings of no progress in critical thinking ability in the course of nursing education, along with some related findings, pose

perplexing questions. Several studies point to a lack of relationship between critical thinking/general problem solving ability and clinical judgment/clinical problem solving ability.

Tanner (1977), studying senior baccalaureate nursing students, found no relationship between WGCTA scores and any of seven dependent measures related to clinical judgment.

Although Frederickson and Mayer (1977) report that baccalaureate students scored significantly higher than associate degree students on a standard critical thinking test, they found no significant differences between the two groups in clinical problem solving.

Matthews and Gaul (1979), studying undergraduate and graduate students found no significant difference between the two groups, scores on the WGCTA but report that the graduate students demonstrated significantly greater ability to derive nursing diagnoses from a case study.

Gordon (1980) studied the influence of inferential ability (as measured by either the Miller Anaology Test or the Verbal Aptitude Subtest of the Graduate Record Examination) on clinical hypothesis-scanning strategy, diagnostic accuracy, and confidence. Level of inferential ability did not significantly influence predictive hypothesis testing.

Dungan (1986) found no significant differences between students at varying levels of nursing education on the Cornell Critical Thinking Test but did find a significant difference on performance on the Nursing Process Utilization Inventory which tests ability to generate nursing problems and appropriate interventions for a clinical simulation.

Pardue (1987) reports that master's and baccalaureate prepared nurses had higher critical thinking scores than associate degree and diploma prepared nurses but found no significant differences between the groups in self reported measures of clinical decision making.

There is evidence, however, of a relationship between critical thinking/general problem solving and clinical judgment/clinical problem solving. If one takes the position that achievement in nursing course and achievement on the NCLEX are measures of clinical problem solving ability, some of the correlations in the present study are of interest. The emphasis in the NCLEX-RN on the nursing process makes a particularly good case for viewing this examination as a measure of clinical problem solving ability. The test plan states: "The phase of the nursing process to be measured in the licensure examination are grouped under the broad categories of Assessment, Analyses, Planning, Implementation and Evaluation." (National Council of State Boards of Nursing, Inc., 1987, p. 2). The phases are defined as follows: assessment "establishing a data base"; analysis - "identifying actual or potential health care needs/problems based on assessment"; planning - "setting goals for meeting client's needs and designing strategies to achieve these goals"; implementation - "initiating and completing actions necessary to accomplish the defined goals"; evaluation - "determining the extent to which goals have been achieved." (National Council of State Boards of Nursing, Inc., 1987, pp. 3-5.)

The following correlations between NCLEX scores and composite CTA Scores in the present study are of particular interest: practical

nursing students - Fall CTA: .5494 (p = .001), Spring CTA: .5587 (p = .011); associate degree students - Fall CTA: .5224 (p = .011), Spring CTA: .5090 (p = .001).

Most correlations between nursing grade point average and composite CTA scores are also significant: practical nursing students - Fall CTA: .5180 (p = .001), Spring CTA: .6476(p = .001); associate degree students - Fall CTA: .3008 (p = .014), Spring CTA: .4716 (p = .001); sophomore students - Fall CTA: .2677 (p = .103), Spring CTA: .4114 (p = .023). It is also interesting to note that the correlation between the practical nursing student Fall to Spring "difference score: and nursing grade point average is .3111 (p = .012).

Correlations between CTA composite scores and grades in the final clinical synthesis course which, in the case of each nursing group, involves integration of learning from previous nursing courses during the academic year were significant only for the practical nursing students - Fall CTA: .3964 (p = .002), Spring CTA: .3825 (p = .002).

Other studies report generally lower correlations of composite CTA scores with NCLEX scores and grade point averages. Bauwens and Gerhard (1987) report a Pearson correlation of .42 between CTA scores on entry of baccalaureate students to the upper division and NCLEX scores. They report a correlation of .50 between exit CTA scores and NCLEX scores. This study also reports a correlation of .32 between entry CTA scores and nursing grade point average and a correlation of .24 between exiting CTA scores and nursing grade point average.

Gross et al. (1987) found a negative but not significant correlation between CTA scores both at entry to and exit from an

associate degree program and NCLEX scores. The correlation between CTA scores on entry to the upper division for baccalaureate students and NCLEX scores was only .18; however, the correlation between CTA scores on exit and NCLEX scores was.38 ($p < .05$). Gross et al. examined overall grade point average but not nursing grade point average.

The evidence presented above is surely mixed. Should we be concerned that there is very little evidence that nursing education increases critical thinking/general problem solving ability as measured by the conventional instruments? Should we be concerned that when critical thinking/general problem solving ability is increased, this increased ability seems to have no effect upon clinical judgment/problem solving in nursing? Conversely, should we be concerned that we find no instances of enhanced clinical judgment/problem solving accompanied by enhancement of critical thinking/general problem solving ability?

Bauwens and Gerhard (1987) conclude that the Watson-Glaser Critical Thinking Appraisal is not a valid measure of specific cognitive processes underlying the nursing process but that the WGCTA is useful as a pre-admission predictor of nursing success. This statement seems to imply that there are other dimensions involved in clinical judgment/problem solving. Several authors concur.

Tanner (1987), in her review of research related to teaching clinical judgment, cites Henderson (1982) who makes the case in somewhat different terms. She questions the assumption that there is a single process for clinical judgment. In her anlaysis of terminology regarding the nursing process, Henderson states that clinical judgment "may be derived from experience but is also intuitive." She adds that nursing

interaction cannot "be divorced altogether from the emotional, or very subjective response of the nurse to the behavior of the patient" and that it "may be dictated by the nurse's past experience or value system." (p. 107)

Gross et al. (1987) refer to Yinger (1980) who holds that all complex thinking has both creative and critical aspects. Murphy (1985) addresses the integration of the creative and the logical when she uses the term "scientific creativity." Referring to Holton (1973), she says; "There is a private aspect of science-in-the-making that is speculative, sometimes irrational, and frequently nonverbal." (p. 103) Referring to Skura (1980), she says: "Creativity is associated with...individuals who demonstrate openness to new ideas, an ability and willingness to see things from less conventional perspectives." (p. 105) Demetrulias (1985) observes that the elusiveness of ideas indicates that original concepts do not usually result from logical thinking and suggests that Aristotle was only partially correct in holding that logical thinking is the one effective way in which to use the mind.

Dungan (1986) also refers to "another dimension." She addresses Robert Ennis' concept of critical thinking as having a logical and a pragmatic dimension. With reference to her study, Dungan proposes that the Cornell Critical Thinking Test measures the logical dimension while the acquisition of nursing knowledge accounts for the pragmatic dimension. Dungan explains the outcome of her research (educational level associated with clinical problem solving but not critical thinking ability as measured by CCTT) in terms of enhancement of the

pragmatic dimension unaccompanied by enhancement of the logical dimension.

The investigator concludes that there are surely dimensions of clinical judgment/problem solving competency that go beyond critical thinking/general problem solving competency measured by the conventional instruments and probably account for some of the incongruities which the research in this area presents. Likewise, the instruments used in the measurement of clinical judgment/problem solving probably deserve additional study. In light of the fact that sophomores in the present study made a significant gain on the WGTCA Inference subscale, further attention might also be given to the differential development of the different kinds of mental processes that are tested by the conventional critical thinking/general problem solving instruments. In any event, it would seem to be a mistake for nursing educators to dismiss all concern for the enhancement of critical thinking/general problem solving ability through nursing education. Surely this ability accounts for at least part of clinical judgment/problem solving competency; furthermore, such ability has relevance for the development and responsible functioning of the nurse as a professional who operates in realms other than the clinical.

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Table 1

Variables Examined in Critical Thinking and Clinical Judgment/Problem Solving Studies

Age	High School Rank	Pre-entrance Testing	College Credits/ Post Sec. Educ.	Grade Point Average
Gross, Takazawa, & Rose (1987)	Polifroni (1981)	Gross, Takazawa, & Rose (1981)	Gross, Takazawa, & Rose (1987)	Bauwens & Gerhard (1987)
Polifroni (1981)	Scoloveno (1981)	Triessen (1986)	Polifroni (1981)	Gorss, Takazawa, & Rose (1987)
Scoloveno (1981)			Scoloveno (1981)	Sullivan (1987)
Tiessen (1986)			Tiessen (1986)	Tiessen (1986)

Health Related/Nursing Work Experience		Nat'l Council Licens. Exam.	Level of Nursing Education	
Aspinall (1976)	Pardue (1987)	Bauwens & Gerhard (1987)	Aspinall (1976)	Ketefian (1981)
Davis (1972)	Polifroni (1981)	Gross, Takazawa, & Rose (1987)	Davis (1972, 74)	Pardue (1987)
Del Bueno (1983)	Scoloveno (1981)		Del Bueno (1983)	Polifroni (1981)
			Dungan (1986)	Scoloveno (1981)
			Frederickson & Mayer (1977)	Verhonick (1968)

Ethnicity	Creative Thinking	Clinical Skill	Moral Judgment
Gross, Takazawa, & Rose (1987)	Sullivan (1987)	Sullivan (1987)	Ketefian (1981)

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Table 2

Demographic Information

	Age Mean (Range)	Tex Mean (Range)	Nex Mean (Range)	Ccr* Mean (Range)	Ego PN	AD	Bac	Mas	Doc
PN	28.9 (18-55)	6.3 (0-21.5)	1.5 (0-6.0)	37.8 (0-240.0)	29.1%	32.7%	29.1%	5.5%	3.6%
Fr.	19.0 (17-35)	1.7 (0-7.0)	0.3 (0-3.0)	2.5 (0-62.0)	0.0%	0.0%	77.3%	18.2%	4.5%
AD	29.4 (19-50)	7.7 (0.4-25)	4.4 (0-19.0)	not available	0.0%	38.5%	53.9%	7.7%	0.0%
Soph.	23.9 (18-36)	4.0 (0-10.0)	0.8 (0-5.0)	138.93 (52.0-267.0)	0.0%	0.0%	41.4%	51.7%	6.9%

*Quarter hour credits or equivalents thereof.

Table 3

A Comparison of Fall CTA Scores of Practical Nursing Students with Pre-Health Science Freshmen

	PN Students		Freshmen			
	M	SD	M	SD	t	p
Inference	8.3091	2.486	8.1053	2.011	.42	.676
Recognition of Assumptions	11.4000	2.528	11.3158	3.180	.14	.887
Deduction	10.2727	2.240	10.6579	2.096	.84	.405
Interpretation	11.8909	1.988	11.8158	2.252	.17	.866
Evaluation of Arguments	10.8545	2.483	12.0000	2.027	2.35	.021*
Composite	52.7273	6.905	53.8947	7.931	.75	.453

Note. df=91

*p <.05

Table 4

A Comparison of Spring CTA Scores of Practical Nursing Students with Pre-Health Science Freshmen

	PN Students		Freshmen			
	M	SD	M	SD	t	p
Inference	8.8909	3.047	9.0789	2.659	.31	.760
Recognition of Assumptions	11.5091	3.150	11.3947	3.036	.17	.862
Deduction	10.2182	2.432	10.6053	2.521	.74	.459
Interpretation	11.8364	1.873	12.0000	2.290	.38	.706
Evaluation of Arguments	10.8000	2.445	11.2895	1.972	1.02	.308
Composite	53.2545	8.466	54.3684	8.566	.62	.536

Note. df=91

Table 5

A Comparison of Fall CTA Scores of Associate Degree Students with Sophomore Generic Baccalaureate Students

	Associate Degree		Sophomores				
	M	SD	M	SD	t	df	p
Inference	8.8909	2.917	10.4138	2.044	2.79	75.35[a]	.007*
Recognition of Assumptions	11.7455	2.633	13.9655	2.026	3.96	82.00	.000*
Deduction	10.3818	2.353	12.4483	2.080	3.98	82.00	.000*
Interpretation	11.9636	1.990	13.5517	2.164	3.37	82.00	.001*
Evaluation of Arguments	11.1818	2.195	13.4483	1.549	4.94	82.00	.000*
Composite	54.1636	8.288	63.8276	6.459	5.46	82.00	.000*

[a]Represents separate variance estimate

*$p < .05$

Table 6

A Comparison of Spring CTA Score of Associate Degree Students with Sophomore Generic Baccalaureate Students

	Associate Degree		Sophomores			
	M	SD	M	SD	t	p
Inference	8.7455	2.246	11.4483	2.164	5.31	.000*
Recognition of Assumptions	12.0545	3.021	13.2414	3.136	1.69	.095
Deduction	10.3455	2.327	12.3448	2.690	3.55	.001*
Interpretation	11.7273	2.147	13.5517	1.901	3.85	.000*
Evalution of Arguments	11.7091	2.070	12.7241	2.202	2.09	.040*
Composite	54.5818	8.073	63.3103	9.224	4.48	.000*

Note. $df = 82$.

*$p < .05$

Table 7

Differences Between Fall and Spring CTA Scores For Practical Nursing Students

	M	SD	t	p
Inference	+.5818	3.583	1.20	.234
Recognition of Assumptions	+.1091	3.107	.26	.796
Deduction	-.0545	3.052	.13	.895
Interpretation	-.0545	2.094	.19	.848
Evaluation of Arguments	-.0545	2.909	.14	.890
Composite	.5273	6.179	.63	.530

Table 8

Differences Between Fall and Spring CTA Scores for Pre-Health Science Freshmen

	M	SD	t	p
Inference	+.9737	2.726	2.20	.034*
Recognition of Assumptions	+.0789	3.183	.15	.879
Deduction	-.0526	2.650	.12	.903
Interpretation	+.1842	2.381	.48	.636
Evaluation of Arguments	-.7205	2.609	1.68	.102
Composite	+.4737	7.348	.40	.693

*$p < .05$

Table 9

Differences Between Fall and Spring CTA Scores for Associate Degree Students

	M	SD	t	p
Inference	-.1455	2.864	.38	.708
Recognition of Assumptions	+.3091	3.237	.71	.482
Deduction	-.0364	3.000	.09	.929
Interpretation	-.2364	2.341	.75	.457
Evaluation of Arguments	+.5273	2.530	1.55	.128
Composite	+.4182	7.345	.42	.675

Table 10

Differences Between Fall and Spring CTA Scores for Sophomore Generic Baccalaureate Students

	M	SD	t	p
Inference	+1.0345	2.044	2.73	.011*
Recognition of Assumptions	-.7241	2.389	1.63	.114
Deduction	-.1034	2.944	.19	.851
Interpretation	0.0	1.852	0.0	1.000
Evaluation of Arguments	-.7241	2.520	1.55	.133
Composite	-.5172	7.264	.38	.704

*$p < .05$

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Table 11

Pearson Correlation Coefficients: Practical Nursing Students

	CTA Comp Spring	CTA Comp Dif	Age	Nex	Tex	Ego	Ccr	Ngpa	Synth	NCLEX
CTA Comp Fall	.6943* p=.001	-.1663 p=.113	.1967 p=.075	-.1923 p=.080	.1164 p=.199	.3127* p=.010	.2378* p=.040	.5180* p=.001	.3964* p=.002	.5494 p=.001
CTA Comp Spring		.5942* p=.001	.2278* p=.047	-.0659 p=.316	.0963 p=.242	.3128* p=.010	.1763 p=.099	.6476* p=.001	.3825* p=.002	.5587* p=.001
CTA Comp Dif			.0923 p=.251	.1246 p=.182	.0018 p=.495	.0791 p=.283	-.0241 p=.431	.3111* p=.012	.0807 p=.283	.1516 p=.139
Age				.0203 p=.442	.6942* p=.001	-.2018 p=.070	.0632 p=.323	.2830* p=.020	.0412 p=.385	.3805* p=.002
Nex					.3156* p=.009	.1047 p=.223	.0174 p=.450	-.2559* p=.032	-.2630* p=.029	-.1177 p=.201
Tex						-.1817 p=.092	.0252 p=.427	.0672 p=.316	-.0367 p=.397	.2093* p=.066
Ego							.2929* p=.015	.1932 p=.083	.0354 p=.401	.2020 p=.073
Ccr								.2721* p=.024	-.0042 p=.488	.1040 p=.229
Ngpa									.5260* p=.001	.6604* p=.001
Synth										.3525* p=.005

*p <.05

Table 12

Pearson Correlation Coefficients: Pre-Health Science Freshmen

	CTA Comp Spring	CTA Comp Dif	Age	Nex	Tex	Ego
CTA Comp Fall	.6057* p=.001	-.3734* p=.010	.3828* p=.009	.0005 p=.499	.0309 p=.427	.1075 p=.301
CTA Comp Spring		.5120* p=.001	.1884 p=.129	-.1077 p=.260	.0269 p=.436	.1711 p=.202
CTA Comp Dif			-.1935 p=.122	-.1261 p=.225	-.0020 p=.495	.1098 p=.297
Age				.5962* p=.001	.2635 p=.055	-.0920 p=.327
Nex					.059393 p=.362	-.0526 p=.399
Tex						.0970 p=.319

*$p < .05$

Table 13

Pearson Correlation Coefficients: Associate Degree Students

	CTA Comp Spring	CTA Comp Dif	Age	Nex	Tex	Ego	Ccr	Ngpa	Synth	NCLEX
CTA Comp Fall	.5972* p=.001	-.4720* p=.001	.1471 p=.142	-.2239* p=.050	-.1549 p=.129	-.0396* p=.390	-----	.3008* p=.014	-.0111 p=.469	.5224* p=.001
CTA Comp Spring		.4252* p=.001	.1391 p=.156	-.1638 p=.116	-.0139 p=.460	.0900 p=.263	-----	.4716* p=.001	.1604 p=.126	.5090* p=.001
CTA Comp Dif			-.0132 p=.462	.0726 p=.299	.1595 p=.122	.1494 p=.145	-----	.1831 p=.095	.1906 p=.086	-.0426 p=.388
Age				.2041 p=.068	.4200* p=.001	-.0080 p=.478	-----	.0924 p=.255	-.0327 p=.408	.3379* p=.010
Nex					.5723* p=.001	.1248 p=.189	-----	-.0361 p=.399	.1382 p=.162	-.0738 p=.311
Tex						.2135 p=.064	-----	-.0712 p=.306	-.0193 p=.445	-.0921 p=.269
Ego							-----	-.0021 p=.494	-.0583 p=.344	.0498 p=.373
Ccr								-----	-----	-----
Ngpa									.7224* p=.001	.4569* p=.001
Synth										.2329 p=.058

*p <.05

Table 14

Pearson Correlation Coefficients: Sophomore Generic Baccalaureate Students

	CTA Comp Spring	CTA Comp Dif	Age	Nex	Tex	Ego	Ccr	Ngpa	Synth
CTA Comp Fall	.6214* p=.001	-.1002 p=.303	.4607* p=.006	.0422 p=.416	.0240 p=.452	.3087 p=.052	.4145* p=.013	.2677 p=.103	-.1387 p=.259
CTA Comp Spring		.7173* p=.001	.4540* p=.007	-.2660 p=.086	-.0185 p=.463	-.0687 p=.362	.1268 p=.256	.4114* p=.023	-.0793 p=.356
CTA Comp Dif			.1668 p=.194	-.3843* p=.022	-.0456 p=.409	-.3618* p=.027	-.2075 p=.140	.2810 p=.092	.0125 p=.477
Age				-.1877 p=.169	.4292* p=.011	.0760 p=.348	.4169* p=.012	.3860* p=.031	.0052 p=.490
Nex					.4330* p=.011	.0701 p=.362	-.1142 p=.281	-.1908 p=.186	-.2432 p=.126
Tex						-.0980 p=.310	-.0472 p=.406	.0893 p=.339	-.0218 p=.460
Ego							.3790* p=.021	.2943 p=.081	.3326 p=.056
Ccr								.3883* p=.030	.4330* p=.017
Ngpa									.5675* p=.002
Synth									-----

*p <.05